

Notes

Natural History Notes on *Brassolis isthmia* Bates (Lepidoptera: Nymphalidae: Brassolinae) in Northeastern Costa Rica

In this note I summarize observations on the larval natural history of the butterfly *Brassolis isthmia* Bates (Lepidoptera: Nymphalidae: Brassolinae) in northeastern Costa Rica. The gregarious habit of the caterpillars and their associated tent-building behavior make this species an interesting one for further study. This note extends some of the detailed Panamanian observations made by Dunn (1917) for this species to Costa Rica. The genus *Brassolis* is composed of four species (Fruhstorfer, 1924) of which *B. isthmia* represents the group in Central America and Colombia.

The study site is "Finca La Tirimbina" near La Virgen (220 m elev.), 10°23'N, 84°07'W (Heredia Province), within the Premontane Tropical Wet Forest Zone (Holdridge, 1967). A group of *B. isthmia* caterpillars was studied from 8-11 July 1982 in this locality and subsequently by rearing them in captivity through pupation and eclosion. Field observations consisted of determining diurnal feeding periods over three successive days for caterpillars as well as noting defensive behavior. Once they had been collected for rearing, descriptive (morphological) notes were taken on the caterpillars and pupae. A determination of the food plant was made along with noting the patterns of defoliation, presence of previously occupied communal nests, and association of caterpillars with the presently-occupied nest. Samples of the caterpillars, head capsules, pupal cases, and adults have been deposited in the collections of the Milwaukee Public Museum.

A second group of caterpillars discovered on the same tree on 29 February 1984 were used to test the idea that *B. isthmia* can successfully switch from *Chaemodora* palm to *Cocos* palm as a food plant. The ten caterpillars were found in a single tent on the *Chaemodora* and transferred 10 days later to *Cocos*. Observations were then made on feeding and survival of the caterpillars.

Ten caterpillars formed a single communal nest on the food plant. Most were 60-65 mm long with maximal width of head capsule (left-to-right axis) being 7 mm. Head capsule shiny black and covered with short, scattered white setae (Fig. 1). Three small white spots on each side of the head, adjacent to mandibles. No red markings of the kind reported by Fruhstorfer (1924) for the related *B. astyra* Stick in Brazil. Head suture reddish. General background color of body reddish-brown. Basic color pattern complex series of longitudinal (lengthwise) stripes of varying thickness and intensity of color. Thin dorsal-medial faint yellow line bordered on each side by thicker red-brown line, followed laterally by thick cream-colored line to either side, speckled with dark red flecks. Laterally with very thick area of the background color. Same dorsal pattern of stripes repeated once on each side of body. Ventral area and prolegs reddish. True legs black. Rounded anal plate brown with body segment anterior to it with simple stripe pattern of medial dark red line bordered with white. Same color pattern occurs on "neck" region. Entire body covered with sparse covering of short, whitish setae. Further details of general distribution of setae given for *B. astyra* from Brazil by Fruhstorfer (1924). As reported by Fruhstorfer, overall body profile cylindrical with middle region thickest, tapering near ends, and with frontal view of head capsule broadest at base and tapered

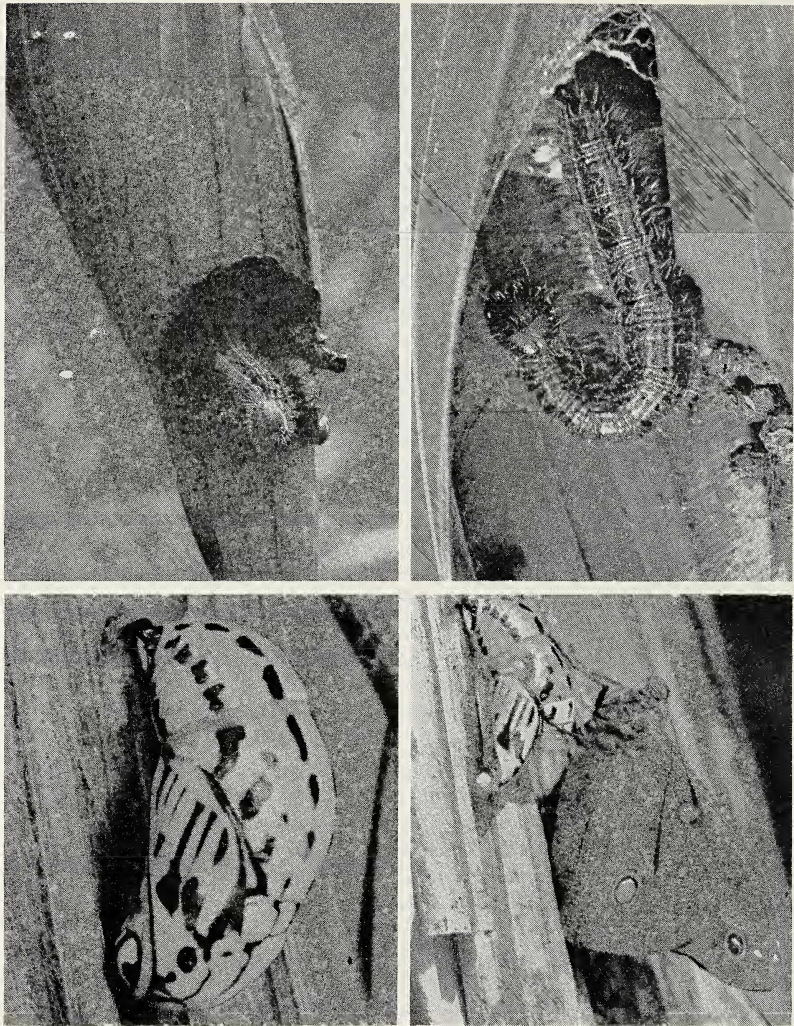


Fig. 1. Clockwise, from top left: *B. isthmia* caterpillar protruding from opening at distal end of nest; final instar caterpillar; pupa; adult eclosion.

dorsally. A partial description of the early stages of *B. isthmia* is given in Dunn (1917).

In captivity the caterpillars grew to about 70-75 mm before contracting to short mobile prepupa stage exhibiting no changes in color. Active prepupa about 40 mm long.

Pupa stout and thick, 23 mm long and maximal dorsal-ventral width 11 mm (Fig. 1). Ground color varying shades of yellow and light pink, with black markings and

black cremaster. Abdominal area with prominent pair of ventral black spots. Black spiracular markings adjacent to reddish spiracles. Dorsal-lateral pair of thick black spots comprising a longitudinal band; also other similar bands medially and more dorsally in same manner (Fig. 1). Thin border of pale yellow arises between ventral-lateral and lateral black bands, followed by thicker band of pink and thick band of deep yellow in dorsal area. Thin alternating bands of faint pinkish-white-to-pink-to-faint-pinkish-white tinged with yellow-to-pink-to-faint-pinkish-white found between the lateral and dorsal-lateral black longitudinal bands. Between the dorsal-lateral and dorsal (medial) longitudinal black bands a series of alternating colors: thin line of pale yellow-to-thick pink band-to-thin border of pale yellow. On second, third, and fourth abdominal segments blackish-brown splotches interrupt yellow areas between the lateral and dorsal-lateral black bands. These paired splotches largest on third segment and smallest on fourth. Each wing pad

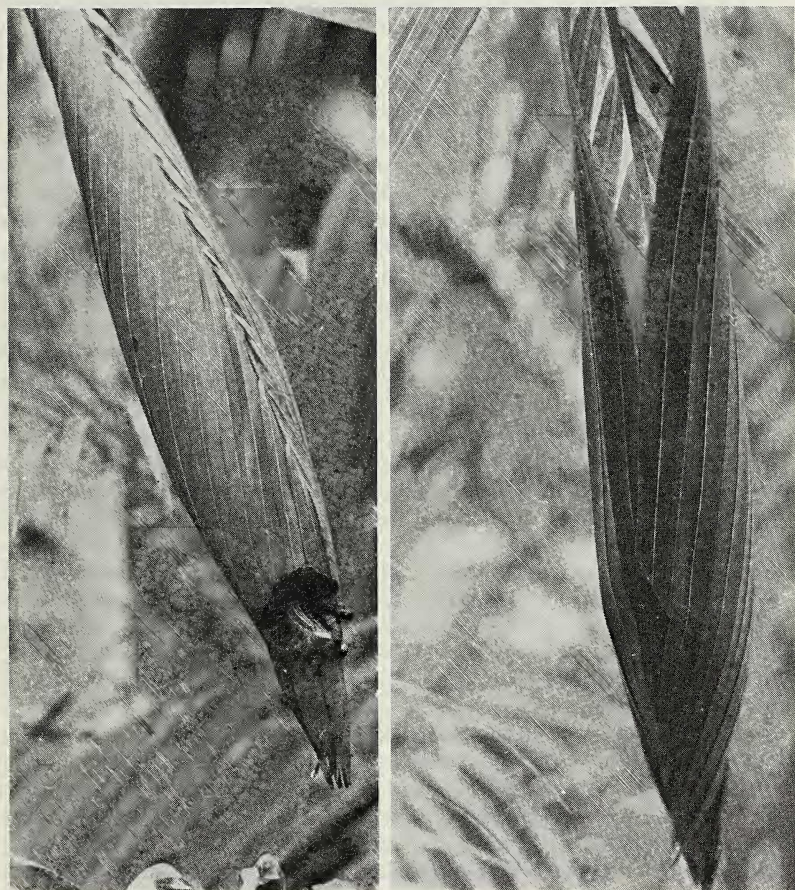


Fig. 2. Caterpillar nest for *B. isthmia*. Left: dorsal view; right: ventral aspect.

yellow and streaked with rusty reddish-brown lines which coalesce into large triangular splotches of same color near base of each wing. Large roundish spot of same color where wing joins thorax. Dorsal area of thoracic region light pink with medial and lateral thin rusty-brown lines (lengthwise). Antennal and leg areas yellow and marked with light rusty-brown lines and spots. Head area yellow with large dorsal-ventral band of dark brown; area of compound eyes bisected into yellow (posteriorly) and dark brown smaller area (anteriorly); palps area deep yellow. Antennal cases sometimes pinkish instead of yellow. Pupa hangs pendant and darkens considerably within a day of eclosion. Final molt to pupa takes 1-2 days. Duration of pupa stage (N=5): 14 days (at about 28°C). Dunn (1917) noted that the pupal stage for this species in Panama lasts 14-17 days. Eclosion requires about 20 min (Fig. 1).

The caterpillars were discovered on a 3 m tall palm tree (*Chaemodora* sp.) growing alongside a small house in a forest clearing. The tree, one of several planted near the house, had been planted as an ornamental at least ten years prior to the discovery.

During the daylight hours, the caterpillars stayed inside a silken tent-like structure (Fig. 2) fashioned by weaving together the pinnae of a single palm frond. The inner surface of the "tube" was lined with thick brown silk. The tube was about 35 cm and 9 cm wide at the middle region. Near the distal end the caterpillars chewed a large opening from which usually 1-2 individuals could be spotted partly exposed during the day (Figs. 1-2). The tent-nest was constructed by anchoring together, in a very orderly manner, the edges of the pinnae curled downward to the axis of the fronds (Fig. 2). The pinnae thus attached remained lush and did not wither. No structural damage to the pinnae or fronds was apparent. There are copious amounts of the silk extending down the fronds to the trunk area of the tree. The opening at the distal end is partly covered with a thin sheet of silk, whereas the proximal area is open and unobstructed. The caterpillars rest on the silken carpeting inside the nest, and all face with heads towards the distal end. Gentle squeezing of the tent did not produce noticeable movement or exodus of the caterpillars. The distal area of the nest, at the time of discovery, contained large accumulations of grass and two dead caterpillars. But large nests in coconut palms in Panama are often open at this end, allowing free passage of fecal matter to the ground (Dunn, 1917).

When prodded with forceps, the caterpillars with head capsules exposed at distal opening of the nest (Fig. 2) reacted defensively in attempting to bite the forceps. The caterpillar possesses a ventral glandular opening just anterior to the prothoracic legs. This structure appears similar to that found in the caterpillars of *Morpho* (A. M. Young, unpubl. data). No noticeable odor was detected, however, when the caterpillars were disturbed.

A striking behavioral feature of larvae was their crepuscular feeding habit. On the three evenings of study, all of the caterpillars exited from the nest in unison between 1710 and 1730 hours (i.e., about 1 hr after sunset), and fed for approximately 45 min before returning in unison to the nest. The caterpillars leave the nest one by one, forming a line and crawling to another frond for feeding. Two of the ten caterpillars were considerably smaller than the others, although their feeding behavior did not vary.

One of the fronds used for feeding had an old and abandoned nest, and this section of the leaf was not fed upon. Another frond had another abandoned nest of

similar size. During one feeding period (9 July), four caterpillars lined up on one pinna to feed, two on an adjacent one, and two more on another pinna of the same frond. As reported for *B. astyra* by Fruhstorfer, a loud clicking noise could be heard as the caterpillars fed. Checks at other times of the day, including the period of 0500 to 0700 hours, revealed no feeding activity by the caterpillars, indicating that they feed just after dusk each day. Caterpillars always leave and reenter the nest from the proximal end. Although Dunn (1917) reported that the caterpillars feed only at night, I would modify this statement somewhat by suggesting a crepuscular feeding habit, i.e., one in which there is a brief feeding period about an hour after dusk. The same palm tree contained active nests of two different social paper wasps (unidentified polybiines) and no interactions with the caterpillars were observed.

During the daylight hours of the third day of study, I checked the "feeding" fronds for signs of silken trails but could find none. I deliberately rubbed my hands over the stems of the fronds involved, including the one with the nest. When the caterpillars exited that evening, they exhibited "confused" and disoriented behavior. Three caterpillars quickly crawled to the fronds used for feeding. The remaining six followed suit only part way, but then reversed their direction and went back down the stem. Three individuals began feeding on a pinna near the tip of the fronds, and another two at a basal pinna. Another caterpillar returned immediately to the nest without feeding and remained inside for about five minutes before exiting again. Three others crawled to a different frond but eventually turned around and joined up with the one (see above) leaving the nest for a second time. These four caterpillars then went back to the original fronds used for feeding on previous days. The tenth caterpillar was unaccounted for and possibly missed during the tracking observations. When crawling, each caterpillar characteristically arches its head upwards and waves it from side to side. Further observations of behavior of caterpillars, in different instars, is given by Dunn (1917).

Rearing was accomplished by placing the entire fronds bearing the nest in a large clear plastic bag, adding an additional frond, and keeping the bag shut. The caterpillars continued to exhibit the same diurnal feeding pattern in captivity as on the tree. Pupation sites varied considerably in the bag, with two being on the silken mat near the proximal end of the nest.

When transferred to *Cocos*, third-instar caterpillars fed successfully and pupated. Such an observation suggests some feeding flexibility in *B. isthmia* caterpillars for feeding on various Palmae.

Brassolis (Fig. 3) is one of two genera that very characteristically lacks the prominent bifid tail so diagnostic of caterpillars of several other brassolid genera (Fruhstorfer, 1924). Both the related Satyridae and Morphidae have caterpillars with bifid tails, a character often used to link these groups (e.g., Miller, 1968).

Fruhstorfer (1924) described the egg, final instar caterpillar and "bag" nests of *B. astyra* in Brazil. He reported that the larval period in this species lasts 7-8 months, a period similar to that of *Morpho* (Young and Muysshondt, 1972). Both Jones (1882) and Fruhstorfer (1924) report that sometimes several hundred caterpillars of *B. astyra* occur in a single nest. Larger nests and great numbers of caterpillars per nest are known for *B. isthmia* for the Limon region of Costa Rica's Caribbean rain forest lowlands. Dunn (1917) reported egg masses for *B. isthmia* ranging from 150 to 300 in Panama. Dunn also found from 50 to 2000 caterpillars in a nest.

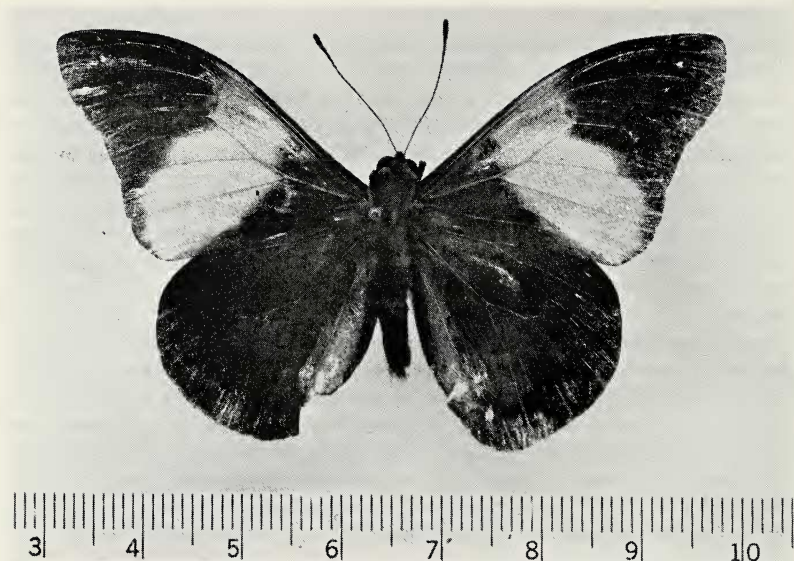


Fig. 3. Adult *B. isthmia* (male) reared in this study.

Like other brassolids such as *Opsiphanes*, adult *B. isthmia* are markedly crepuscular in habit, with reproductive behavior confined to the dusk period (see also Young and Muysshondt, 1975 and Young, 1977, for *Opsiphanes*). Jones (1882) noted that pupation in *B. astyra* occurred away from the nest, while Fruhstorfer (1924) reports pupation within the nest. Dunn (1917) reported pupation outside the nest for *B. isthmia* in Panama, where high numbers of caterpillars per nest have been found in coconut palms. Under conditions of low density, some pupation may occur within the nest (Fig. 4).

Various authors (Jones, 1882; Fruhstorfer, 1924; Brown, 1972) have commented upon the cycling of brassolid broods in South America. In more than a decade studying Lepidoptera at La Tirimbina, the data reported here comprise the first set of observations on *B. isthmia*. The butterfly may exhibit seasonal cycles of abundance even within a relatively non-seasonal area like northeastern lowland Costa Rica, a factor contributing to its apparent scarcity at this locality. Seasonal cycles of abundance in which there are two, somewhat overlapping broods each year have been noted for *B. isthmia* in Panama, where this butterfly has been a defoliator of coconut palms (Dunn, 1917). In the Limon area, the butterfly is commonly associated with very large palm trees, suggesting a lower understory habit within natural rain forest. In close to ten years of bait-trapping many brassolids on the ground cover of rain forest in this region of Costa Rica, I have never captured *B. isthmia*. The butterfly might be more active in upper layers of the forest than near the ground.

Both the cryptic coloration of the caterpillars and the dusk-feeding habit suggest a passive defense against natural enemies. The function of the glandular opening

near the prothoracic legs remains unknown. Whether or not the function is associated with defense or with establishing an odor trail used in communal feeding and nesting habits remains to be studied. During the larval period, several different nests might be used on a single food plant, as suggested by the occurrence of

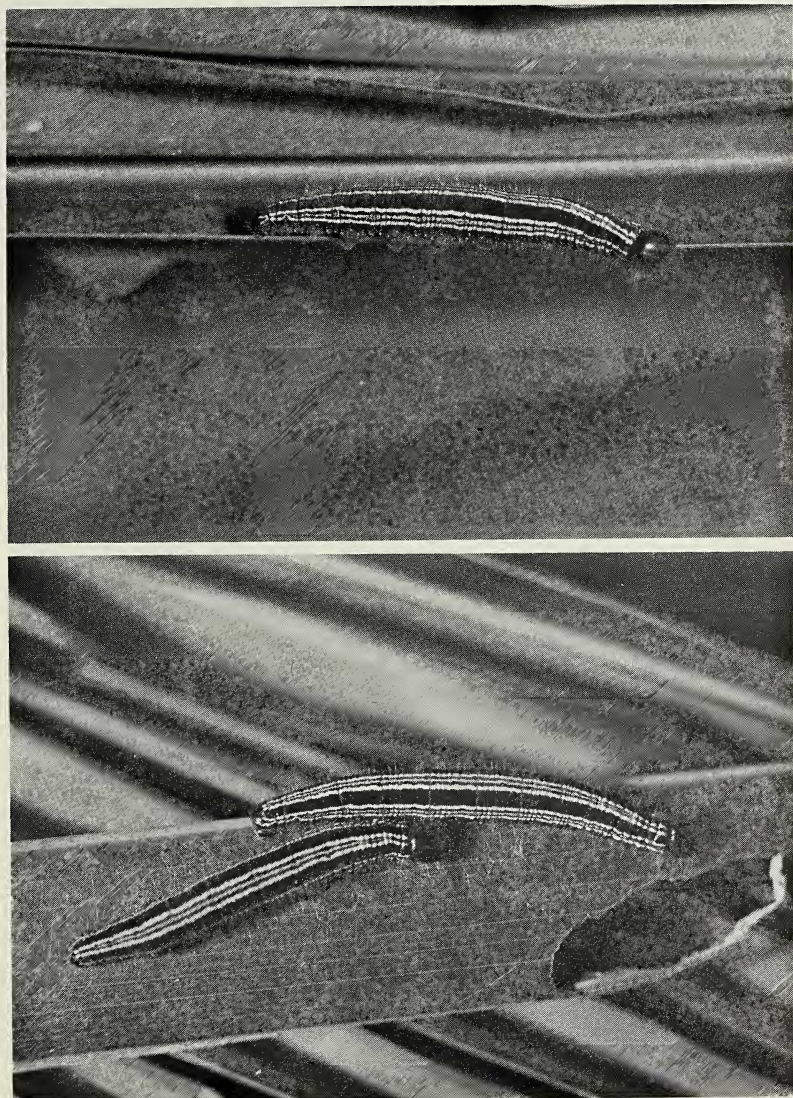


Fig. 4. Above: single final-instar caterpillar searching for pupation site; below: two fifth-instar caterpillars preparing "communal" pupation site on fronds of food plant.

two unoccupied nests on the palm under observation in the present study.

I thank Dr. J. Robert Hunter for showing me the caterpillars on the palm tree next to his home at La Tirimbina.

Literature Cited

- BROWN, K. S., Jr., 1972. Maximizing daily butterfly counts. *J. Lepid. Soc.* 26:183-196.
- DUNN, L. H., 1917. The cocoonut-tree caterpillar (*Brassolis isthmia*) of Panama. *J. Econ. Ent.* 10:473-488.
- FRUHSTORFER, H., 1924. *Brassolis*. pp. 286-288, In A. Seitz (ed.), *Macrolepidoptera of the world*. Vol. 5. American Rhopalocera. Stuttgart: Kernan Verlag.
- JONES, D., 1882. Metamorphoses of Lepidoptera from Sao Paulo, Brazil. Nomenclature and descriptions of new forms. *Proc. Lit. & Philosop. Soc. Liverpool* 36:327-377.
- MILLER, L. D., 1968. The higher classifications, phylogeny and zoogeography of the Satyridae (Lepidoptera). *Mem. Amer. Ent. Soc.* No. 24.
- YOUNG, A. M., 1977. Notes on the defoliation of coconut palm (*Cocos nucifera*) by the butterfly *Opsiphanes quiteria quirinus* (Lepidoptera: Brassolidae) in northeastern Costa Rica. *Deutsche Ent. Zeitschr.* 24:353-365.
- YOUNG, A. M. & A. MUYSHONDT, 1975. Studies on the natural history of Central American butterflies in the family cluster Satyridae-Brassolidae-Morphidae (Lepidoptera: Nymphaloidea). II. *Opsiphanes tamarindi* and *Opsiphanes cassina* in Costa Rica and El Salvador. *Stud. Neotrop. Fauna* 10:19-56.

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Moss-Feeding by a Satyrine Butterfly

A previous paper (Singer, M.C., P. R. Ehrlich and L. E. Gilbert, 1971. Butterfly feeding on Lycopoid, *Science* 172:1341-1342) gave the first report of butterflies using lycopsids as larval hosts. *Euptychia jesia* (misidentified in the paper as *E. westwoodi*) was found to feed on *Selaginella horizontalis* in Panama. Since that time one of us (MCS) has found three other species of *Euptychia*, including the real *E. westwoodi*, to be host-specific on particular selaginellas in Costa Rica. We report here what we believe to be the first observation of moss-feeding by a butterfly. At Corcovado National Park, Costa Rica, *Euptychia insolata* was observed alighting on green tree trunks in oviposition search mode. We found six green spherical eggs and subsequently observed oviposition on the epiphytic moss *Necckeropsis undulata*. From the six eggs we were able to raise five adults on this host. We do not know whether other hosts are also used. The larvae of *E. insolata* are extremely cryptic, being both moss-shaped and moss-colored. A photograph of one on its host, taken by L.E. Gilbert, has been used as an example of camouflage in a general biology text (page 9 in Purves, W. K. and G. H. Orians, 1983: *Life, the Science of Biology*. Sinauer). We suspect that many of the South American *Euptychiines* will eventually be found to feed on "lower" plants.

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